

CLAIMS

1. A method of purifying water, the method comprising the steps of:

(i) adding a treatment agent to the water;

(ii) passing the water through a mixing zone; and

5 (iii) passing the water through a foam fractionation zone to provide purified water.

2. The method of claim 1 wherein steps (i) and (ii) precede step (iii).

3. The method of claim 1 wherein steps (i) and (ii) both precede and follow step (iii).

4. The method of claim 1 wherein a foaming agent is added prior to step (iii).

10 5. The method of claim 1 wherein the water is passed through a flocculation zone prior to step (iii).

6. The method of claim 5 wherein the water remains in the flocculation zone for 2-15 minutes.

15 7. The method of claim 6 wherein the water remains in the flocculation zone for 4-7 minutes.

8. The method of claim 5 wherein a flocculant is added to the water prior to passing the water through the flocculation zone.

9. The method of claim 1 including the step of ensuring the pH of the water falls within the range 6.5-8.5 pH.

20 10. The method of claim 9 including the step of ensuring the pH of the water falls within the range 6.5-7.5 pH.

11. The method of claim 1 wherein the mixing zone comprises one or more mixing columns.

12. The method of claim 11 wherein the water is in contact with the treatment agent for 2-6 minutes before the water is passed into the foam fractionation zone.

13. The method of claim 1 wherein the treatment agent is selected from the group consisting of oxidizing, anti-microbial and flocculating agents.

5 14. The method of claim 13 wherein the oxidising agent is selected from the group consisting of chlorine, bromine, ozone, peroxyacetic acid and hydrogen peroxide.

15. The method of claim 13 wherein the anti-microbial agent is selected from the group consisting of ultra violet light, chlorine and iodine.

10 16. The method of claim 13 wherein the flocculating agent is selected from the group consisting of alum sulphate, polyaluminium chloride, ferric sulphate, ferric chloride and inorganic salt-polymer blends.

17. The method of claim 1 wherein the foam fractionation zone comprises a fractionation column.

15 18. The method of claim 17 wherein the rate of flow of water through the fractionation column falls within the range 1000-3400 L/min/m².

19. The method of claim 18 wherein the rate of flow falls within the range 2600-2800 L/min/m².

20 20. The method of claim 17 wherein water enters the fractionation column through a first water inlet located around the top of the column and a second water inlet comprising a gas injection means located around a base of the column.

21. The method of claim 20 wherein gas injected into the second water inlet falls within the range of 20-50% of the total water flow through the second water inlet.

22. The method of claim 1 wherein the water undergoes a second pass through the

foam fractionation zone.

23. A system for purifying water, the system including a mixing zone comprising one or more mixing columns for mixing the water with a treatment agent and a foam fractionation zone for purifying the water, the foam fractionation zone in liquid communication with the mixing zone.

24. The system of claim 23 wherein the foam fractionation zone includes a foam fractionation column.

25. The system of claim 23 and claim 24 wherein the foam fractionation zone includes a foam height adjustment valve for varying the level of water within the foam fractionation column.

26. The system of any one of claims 23, 24 and 25 that further includes a flocculating column.

27. The system of any one of claim 23 to claim 26 that further includes a pH sensor and pH adjustment means.

28. The system of any one of claim 23 to claim 27 that further includes one or more treatment agent injection means.

29. The system of any one of claim 23 to claim 28 that further includes one or more water storage tanks.

30. The system of any one of claim 24 to claim 29 wherein the foam fractionation column comprises:

- (i) a column body;
- (ii) a column base;
- (iii) a first water inlet located around the top of the column body;

(iv) a second water inlet located in the column base and including gas injecting means for introducing gas into said second water inlet;

(v) a water outlet located in the column base;

(vi) a foam formation zone located at the top of the fractionating column
5 above the first water inlet; and

(vii) a foam compression zone located above the foam formation zone comprising a frusto-conical section and a foam outlet;

wherein the length of the column body is between 150-200% greater than the length of the column base, the diameter of the column base is at least 50%
10 larger than the diameter of the column body and the base and body of the column are interconnected by a frusto-conical section, the edges of the frusto-conical section sloped at 45-80 degrees.

31. The system of claim 30 wherein the edges of the frusto-conical section are sloped at around 60 degrees.

15 32. The system of claim 25 wherein the foam height adjustment valve comprises:

(i) a housing with a central bore positioned in the housing;

(ii) one or more bushes positioned in the housing;

(iii) a valve stem threadably engaged with the bushes;

(iv) a handle located at a proximal end of the stem;

20 (v) a valve located at a distal end of the stem; and

(vi) a least one or more air pathways located in the bushes and adapted to provide communication between external air and an internal space of a conduit to which the valve assembly is attached.

33. A foam fractionation column comprising:

- (i) a column body;
- (ii) a column base;
- (iii) a first water inlet located around the top of the column body;
- 5 (iv) a second water inlet located in the column base and including gas injecting means for introducing gas into said second water inlet;
- (v) a water outlet located in the column base;
- (vi) a foam formation zone located at the top of the fractionating column above the first water inlet; and
- 10 (vii) a foam compression zone located above the foam formation zone comprising a frusto-conical section and a foam outlet;

wherein the length of the column body is between 150-200% greater than the length of the column base; the diameter of the column base is at least 50% larger than the diameter of the column body and the base and body of the column are interconnected by a frusto-conical section, the edges of the frusto-conical section sloped at 45-80 degrees.

34. The foam fractionation column of claim 33 wherein the edges of the frusto-conical section are sloped at around 60 degrees.

35. The foam fractionation column of claim 33 and claim 34 further including a foam removal apparatus, the foam removal apparatus comprising:

- (i) a discharge conduit in communication with the foam outlet of the foam fractionation column;
- (ii) a spray nozzle housed within the conduit, the spray nozzle in liquid

communication with a motive flow source; and

(iii) at least one or more air pathways located in the conduit to provide communication between external air and an internal space of the conduit.

36. A valve assembly for varying the level of water within a foam fractionation column, the valve assembly comprising:

(i) a housing with a central bore positioned in the housing;

(ii) one or more bushes positioned in the housing;

(iii) a valve stem threadably engaged with the bushes;

(iv) a handle located at a proximal end of the stem;

(v) a valve located at a distal end of the stem; and

(vi) at least one or more air pathways located in the bushes and adapted to provide communication between external air and an internal space of a conduit to which the valve assembly is attached.

37. The valve assembly of claim 36 wherein the one or more bushes comprise two spaced bushes.

38. The valve assembly of claim 36 or claim 37 in liquid communication with the foam fractionation column of claim 33.